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A new species and a new record of *Marasmius* from China

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Abstract —*Marasmius pseudoconfertus* is described and illustrated as a new species of section *Sicci* series *Leonini*. It has a reddish brown pileus, subdistant lamellae, a fuscous to dark brown stipe, basidiospores 13–16 × 4–5 µm, and lacks pleurocystidia and caulocystidia. *Marasmius suthepensis* is reported for the first time from China.

Key words — morphology, *Marasmiaceae*, taxonomy

Introduction

Taxonomic studies of *Marasmius* have been extensively carried out in the world (e.g. Singer 1964, 1976; Desjardin & Horak 1997, Desjardin & Ovrebo 2006, Antonín 2003, Antonín & Buyck 2006, Antonín & Noordeloos 2010). Recently the morphological and molecular studies of Asian *Marasmius* species were extensively conducted (Tan et al. 2009, Wannathes et al. 2009, Antonín et al. 2010a, b), whereas the species of *Marasmius* from China are still poorly known. Although Karsten (1892) reported the first records of *Marasmius* from China, the reported species *M. dryophilus* (Bull.) P. Karst. and *M. butyraceus* (Bull.) P. Karst. are currently accepted as *Gymnopus dryophilus* (Bull.) Murrill and *Rhodocollybia butyracea* (Bull.) Lennox. Teng (1963) recorded 6 species, Tai (1979) provided a comprehensive account of *Marasmius* with a list of 23 Chinese taxa, and only the species of *Marasmius* from Guangdong and Hainan provinces were studied relatively intensively (Bi et al 1985, 1993; Bi & Li 1987, Li et al. 1994), although a few other records have also been reported from other areas in China. During a recent critical re-examination on the specimens deposited in the Herbarium of Cryptogams, Kunming Institute of Botany of the Chinese Academy of Sciences (KUN, with HKAS numbers) and Herbarium of Guangdong Institute of Microbiology (GDGM), a new species and a new record for China were discovered. They are described and illustrated herein.

Materials & methods

Specimens were annotated and photographed in the field, dried in an electric drier, and then preserved in the herbarium. Color terms and notations follow those of Kornerup & Wanscher (1978). Fungal tissues were mounted in 5% KOH for microscopic examination. The terms used to describe lamellae spacing refer to the number of lamellae reaching from the stipe to the pileus margin, and the spacing of lamellulae is indicated by the number of series present. Spore statistics include: x_m, the arithmetic mean of the spore length by spore width (± standard deviation) for n spores measured in a single specimen; Q, the quotient of spore length by spore width in any one spore, indicated as a range of variation in n spores measured; Qm, the mean of Q-values in a single specimen; n, the number of spores measured per specimen; s, the number of specimens involved. Specimens are deposited in the Herbarium of Cryptogams, Kunming Institute of Botany of the Chinese Academy of Sciences (KUN) and Herbarium of Guangdong Institute of Microbiology (GDGM). Authors of fungal names are cited according to the International Plant Names Index Authors website (http://www.ipni.org/ipni/authorsearchpage.do).

Genomic DNA was isolated from dried specimens and the ITS1-5.8S-ITS2 segment from the ribosomal DNA (rDNA) was amplified with primer sets ITS1 (5'-TCC GTA GGT GAA CCT GCG G-3') and ITS4 (5'-TCC TCC GCT TAT TGA TAT GC -3') by polymerase chain reaction (PCR) techniques (White et al. 1990). Amplified products were examined with agarose gel electrophoresis using a 2kb DNA marker. The amplified PCR products were directly sequenced and deposited in GenBank.

Taxonomy

Marasmius pseudoconfertus T.H. Li & Chun Y. Deng, **sp. nov.** Figs 1–2

MycoBank MB 519525

Pileus 15–35 mm latus, hemisphaericus vel plano-convexus, non-striatus, glaber, aurantiacus. Lamellae adnexed, albae, distantes vel subdistantes. Stipes 10–70 × 2–5 mm, apicem albidus, brunneus ad atrobrunneus, basi non-insititius. Basidiosporae 13–16 × 4–5 µm, clavatae vel sublacrymoideae, hyalinae, inamyloideae. Cheilocystidia 12–22 × 4–8 µm, clavata vel vesiculosa. Pleurocystidia nulla. Pileipellis hymeniformis, e cellulis typi Sicci 7–22 × 5–8 µm, clavatis vel irregularibus, setulosis. Caulocystidia nulla. Trama pilei et lamellarum dextrinoidea.

Type: CHINA, Sichuan, Jiulong County. 21 July 2005, 29°16′36″N, 101°28′17″E, alt. 3900 m, Z. W. Ge 593 (**Holotype**, HKAS 49088)..

Etymology: *pseudoconfertus* (Latin), refers to the basidiome's macroscopic resemblance to the species *Marasmius confertus*.

Pileus 15–35 mm, hemispherical, convex to plano-convex, with distinct obtuse umbo at centre, orange (6A7, 6B7) to brownish orange (6C7), paler towards margin, smooth. Lamellae adnexed, subdistant (18-20), white, non-marginate. Stipe 10–70 × 2–5 mm, cylindrical, glabrous, non-insititious, nearly white at apex, becoming grayish orangish (6B4), fuscous to dark brown (7E6–7, 7F6–7) towards base.

Basidiospores 13–16(–18) × 4–5 µm [$x_m = 13.6 \pm 3.4 \times 4.5 \pm 0.15$ µm, Q = 2.3–3.5, Qm = 3.05 ± 0.28, n = 20 spores, s = 1 specimen], clavate to fusoid, smooth,

Figs 1–2: *Marasmius pseudoconfertus* (holotype, HKAS 49088). 1. Basidiomes (Photo: Z.W. Ge); 2. a. Basidiospores, b. Cheilocystidia, c. Pileipellis. Bars: 1 = 1 cm; 2 = 10 μm.

hyaline, inamyloid, thin-walled. Basidia 21–28 × 6–10 μm, clavate, 4-spored. Basidioles 25–30 × 5–7 μm, fusoid to clavate. Cheilocystidia numerous, in form of Siccus-type broom cells; main body 12–22 × 4–8(–10) μm, cylindrical to clavate or irregular in outline, rarely lobed, hyaline, inamyloid, thick-walled; apical setulae 5–12 × 1–2(–3) μm, narrowly cylindrical, rarely forked, light yellow, inamyloid, thick-walled. Pleurocystidia absent. Pileipellis hymeniform, mottled, composed of Siccus-type broom cells; main body 7–22 × 5–8(–10) μm, cylindrical to clavate or irregular in outline, rarely lobed, hyaline,

inamyloid to weakly dextrinoid, thick-walled; apical setulae 5–12 × 1–2(–3) μm, cylindrical, obtuse, rarely forked, light yellow, inamyloid, thick-walled. Pileus trama of interwoven, inflated hyphae; hyphae 5–13 μm in diam., cylindrical, hyaline, strongly dextrinoid, thin-walled, non-gelatinous. Lamellae trama regular, hyphae 5–8 μm in diam., cylindrical, hyaline, strongly dextrinoid, thin-walled, non-gelatinous. Stipe tissue monomitic; cortical hyphae 5–8 μm in diam., parallel, cylindrical, smooth, light yellow (at apex) to yellow or yellow brown (at base), dextrinoid, thick-walled, non-gelatinous; medullary hyphae 3–5 μm wide, parallel, cylindrical, smooth, hyaline, inamyloid, thin-walled. Caulocystidia absent. Clamp connections present.

Ecology and distribution—Scattered to gregarious on debris in broad-leaved forest in July; China (Sichuan).

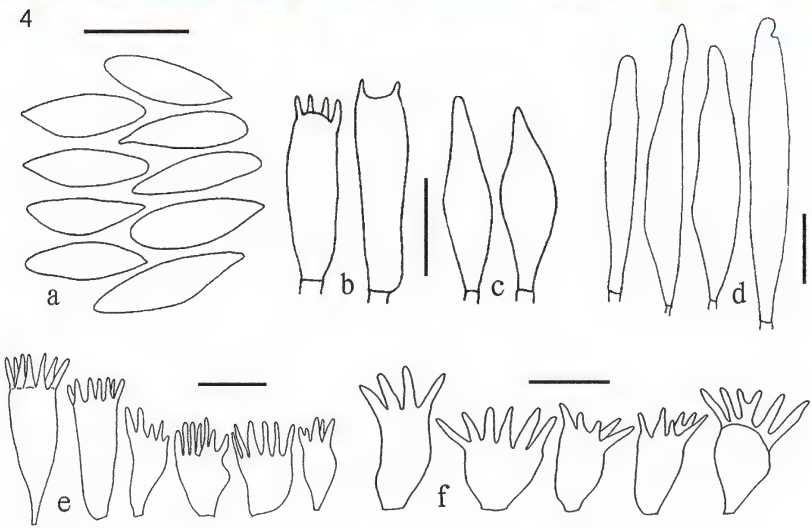
Comments—The new species has a Siccus-type pileipellis, but does not possess any hymenial setae, pileosetae, and pleurocystidia. It belongs to sect. *Sicci* series *Leonini* based on a lack of pleurocystidia, a central well-developed stipe, and a pileipellis composed of Siccus-type broom cells. This fungus is most similar to *M. confertus* Berk. & Broome, which differs in the smaller basidiospores (8–10(12) × 4–5(6) μm) and presence of pleurocystidia (Pegler 1977, Wannathes et al. 2009).

The new species also resembles *M. corneri* Wannathes et al., *M. occultatus* Har. Takah., and *M. rubricosus* Mont., all belonging to sect. *Sicci* ser. *Leonini* and sharing moderately large basidiomes and absence of pleurocystidia and setae. *Marasmius corneri,* however, can be distinguished easily by its orange striate to sulcate pileus and larger basidiospores (18–20 × 4–5 μm) (Wannathes et al. 2009). *Marasmius occultatus* differs in having light colored pileus, a more slender stipe (0.8–1.3 mm) and a lignicolous habitat (Takahashi 2000). *Marasmius rubricosus* differs in its densely striate pileus and slightly longer basidiospores (15–18 × 4–5.5 μm) (Singer 1976).

The rDNA-ITS (ITS1-5.8S-ITS2 segment) sequence of 692 bps of the new species (HQ832733) differs from any known *Marasmius* sequences. Through a Blast search against the GenBank DNA database, only 160 bps of 5.8S of the sequence match those of *M. bondoi* (EU935476, EU935474, EU935472, and EU935477). The remaining parts (ITS1 and ITS2, occupying about 76.8% of the whole segment) of the sequence are so different that they are not comparable with any known sequences. Therefore, *M. pseudoconfertus* is considered distinct based on a combination of morphological and molecular characters.

Marasmius suthepensis Wannathes, Desjardin & Lumyong, Fungal Diversity 37: 288. 2009. Figs 3–4

Pileus 8–22 mm broad, obtusely conical to convex, with or without an umbo, smooth to striate, glabrous or pruinose, dull, disc brownish orange (7C6-8)



Figs 3–4: *Marasmius suthepensis* (GDGM 27277). 3. Basidiomes (Photo: C.Y. Deng); 4. a. Basidiospores, b. Basidia, c. Basidioles, d. Pleurocystidia, e. Cheilocystidia, f. Pileipellis. Bars: 3 = 1 cm; 4 = 10 µm.

to light orange (6A4,5), fading to light yellow (4A4), margin orange white (5A2) to light yellow (4A4-5). Context thin, white. Lamellae adnexed to free, subdistant to close (20–22) with 1–3 series lamellulae, 1–2 mm broad, non-intervenose, non-marginate. Stipe 20–55 × 1mm, central, cylindrical, glabrous, apex yellowish white, base reddish brown (8E5-8, 8D4-8), basal mycelium strigose, yellow. Odor and taste not distinctive.

Basidiospores 10–13(–15) × 3.1–4 µm [x_{mm} = 11 ± 1.2 × 3.6 ± 0.2 µm, Q = 2.8–3.1, Q_{mm} = 3.0, n= 25 spores, s = 2 specimen], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia 21–24 × 5.5–7 clavate, 2- or 4- spored. Basidioles cylindrical to clavate. Cheilocystidia abundant, of Siccus-type broom cells; main body 10–20 × 5–11 µm, cylindrical to clavate, hyaline, inamyloid, thin-walled; apical setulae 2–8 × 1–1.5 µm, cylindrical to conical, obtuse to subacute, yellow to yellowish brown, thin walled. Pleurocystidia common, 27–40 × 5–7 µm, cylindrical to fusoid, wavy to constricted and sometimes lobed at the apex, hyaline, inamyloid, thin-walled. Pileipellis hymeniform, mottled, composed of Siccus-type broom cells; main body 7–18 × 4–10 µm, cylindrical to clavate or pyriform, hyaline to pale yellow, inamyloid, thin-walled; apical setulae 3–8 × 1(–1.5) µm, crowded, cylindrical, subacute, brown to light brown, thick-walled. Pileus trama hyphae 6–15 µm diam., interwoven, cylindrical to inflated, smooth, hyaline, strongly dextrinoid, thin-walled. Lamellae hyphae 3–10 µm in diam., cylindrical to inflated, smooth, hyaline, dextrinoid, thin-walled, non-gelatinous; trama interwoven to regular. Stipitipellis hyphae 3–7(–9) µm in diam., subparallel, cylindrical, brown to dark brown, smooth, inamyloid to weakly dextrinoid, thin-walled, non-gelatinous. Stipe trama hyphae 3–7 µm in diam., parallel, cylindrical, hyaline, smooth, dextrinoid, thin-walled, non-gelatinous. Caulocystidia absent. Clamp connections present in all tissues.

Habit, habitat, distribution — Scattered to gregarious on dicotyledonous leaves or on wood, Northern Thailand and China.

> Collection Examined — **China, Guangdong,** Dinghushan National Nature Reserve. 9 August, 2010, C.Y.Deng (GDGM 27277); **Yunnan,** Xishuangbanna Tropical Botany Garden, 26 July, 2006, J.F. Liang 385 (HKAS 50101).

Comments— *Marasmius suthepensis* is common in China. The Chinese specimens are quite similar to those from Thailand except for a paler pileus and slightly smaller basidiospores (Thai material with mean 12.6 × 4 µm; Wannathes et al. 2009).

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